

plating on said seed metal a layer of nickel, by electroless deposition, said layer of nickel having a thickness of at least about 0.5 μm ;

plating on said layer of nickel a layer of gold, by electroless deposition, said layer of gold having a thickness of at least about 0.4 μm ; and

bonding one of said metal wires onto said layer of gold.

23. (amended) The method of Claim 22, wherein said step of plating on said nickel layer a layer of gold comprises the steps of:

conducting a self-limiting surface metal replacement; and
conducting an autocatalytic deposition.

24. (amended) The method of Claim 22, wherein said step of plating on said seed metal a layer of nickel comprises plating a nickel layer having a thickness in the range of about 0.5 μm to about 1.5 μm .

25. (amended) The method of Claim 22, wherein said step of plating on said layer of nickel a layer of gold comprises plating a gold layer having a thickness in the range of about 0.4 μm to about 1.5 μm .

REMARKS

Reconsideration of the above-referenced application in view of the following remarks is respectfully requested.

Claims 7-26 are pending in this application.

Claims 18 and 19 stand objected to for various informalities. The claims have been amended in response to the objection.

Claims 19 and 23-25 stand rejected under 35 U.S.C. 112, second paragraph. Claim 16 has been amended to overcome the rejection of Claim 19. Claims 22-25 have also been amended to overcome the rejection.

Claims 7-10 and 13-26 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Molla, et al. (U.S. Patent No. 6,362,089) in view of Ahmad, et al. (U.S. Patent No. 5,436,412). Applicant respectfully traverses the rejection. Claim 7 includes the step of "plating a layer of a bondable metal, by electroless deposition, said bondable metal and the thickness thereof coordinated such that said layer reduces the diffusion of said barrier metal at 250 °C by more than 80 % compared with the absence of said bondable metal, thereby forming the outermost bondable metal layer of said bond pad." Molla's gold layer is "between approximately 0.03 microns and 0.06 microns." Applicant's specification (page 13, line 20) teaches that a thickness of about 0.4 to 1.5 um is needed to meet the reduction criteria recited in Claim 7. Applicant's range is 7 to 25 times thicker than the top end of Molla's range. Molla's method does not satisfy nor does it anticipate or suggest the criteria set forth for the bondable layer in Claim 7. The Examiner acknowledges this deficiency of Molla and cites Ahmad to cure the shortcomings of Molla. The Examiner asserts that Ahmad teaches "gold being a few microns thick." However, the cited passage of Ahmad reads as follows "N(P) and Co(P) and gold are deposited by electroless plating and are a few microns thick." Applicant respectfully submits that this is not necessarily a teaching that the *gold* is a few microns thick; instead, Applicant understands Ahmad's description to mean that the thickness of the several metal layers is a few microns thick *in total*. The "few microns thick" dimension is clarified somewhat further in col. 5 at line 46 of Ahmad, where it is stated that ". . . caps 42, 44 of nickel(P) or cobalt (P) followed by gold are deposited by electroless plating at a thickness of 1 to 2 microns. . . ." Thus, there is no reason to believe that the gold layer thickness used by Ahmad is any thicker than that taught by Molla. Therefore, Applicant respectfully submits that Claim 7 is patentable over Molla.

Claims 8 and 13-15 depend from Claim 7 and are therefore patentable for at least the reasons presented above.

Additionally, Claim 14 includes the step "wherein said electroless plating of said bondable metal layer is immersion plating followed by autocatalytic plating." It is acknowledged in the Office Action that Molla does not teach autocatalytic plating, but the Examiner argues that autocatalytic plating is well known in the art and that Molla teaches the use of techniques for forming a layer of gold that are well known to those skilled in the art. However, Applicant points out that Claim 14 does not simply recite the use of autocatalytic plating, but rather combines two different plating techniques. Neither Molla nor Ahmad teaches or suggests such an approach.

Claim 16, as amended, includes the step of "plating on said barrier layer a bondable layer, by electroless deposition, said bondable layer having a thickness of at least about 0.4 μm , said bondable layer selected from a group consisting of gold, palladium, platinum, and silver." Claim 22, as amended, includes the step of "plating on said layer of nickel a layer of gold, by electroless deposition, said layer of gold having a thickness of at least about 0.4 μm ." As indicated above with respect to Claim 7, Molla does not teach a bondable layer having a thickness of at least about 0.4 μm . In addition, as argued above, there is no reason to believe that the gold layer thickness used by Ahmad is any thicker than that taught by Molla. For at least this reason, Applicant submits that Claims 16 and 22 are patentable over Molla in view of Ahmad. Claims 17-21 and 23-26 depend from Claims 16 and 22 and are therefore patentable over Molla in view of Ahmad for at least the reasons presented above.

Claims 17 and 23 include the steps of "conducting a self-limiting surface metal replacement; and conducting an autocatalytic deposition." It is acknowledged in the Office Action that Molla does not teach autocatalytic deposition, but the Examiner argues that autocatalytic deposition is well known in the art and that Molla teaches the use of techniques for forming a layer of gold that are well known to those skilled in the art. However, Applicant respectfully points out that Claims 17 and 23 do not simply recite the use of autocatalytic

deposition, but rather combine two different plating techniques. Neither Molla nor Ahmad teaches or suggests such an approach.

Claims 11 and 12 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Molla with Ahmad and further in view of Lopatin, et al. (U.S. Patent No. 6,320,263). Applicant respectfully traverses the rejection. As indicated above, Claim 7 contains features not taught or suggested by Molla or Ahmad. Lopatin does not cure the deficiencies of Molla and Ahmad. Claims 11 and 12 depend from Claim 7 and are therefore patentable over the combined references for at least the reasons presented above.

Claims 7-26 stand provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 16-25 of copending Application No. 09/775,322. Applicant agrees to file a terminal disclaimer prior to the close of prosecution leading to the issuance of a patent in the instant application, unless the abovereferenced copending application no. 09/775,322 is abandoned prior to that time.

In view of the above, Applicant respectfully requests the entry of this amendment, the withdrawal of the Examiner's rejections, and allowance of Claims 7-26. If the Examiner has any questions or other correspondence regarding this application, Applicant requests that the Examiner contact Applicant's attorney at the below listed telephone number and address.

Respectfully submitted,



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Version with Markings to Show Changes Made

In the Claims:

16. (amended) A method for forming metallurgical connections between metal wires and bond pads positioned on integrated circuits having copper interconnecting metallization, comprising:

depositing seed metal to activate the surface of said copper metallization of said bond pads;

plating on said seed metal a barrier layer, by electroless deposition, said barrier layer having a thickness of at least about 0.5 μm , said barrier layer selected from a group consisting of nickel, cobalt, chromium, molybdenum, titanium, tungsten, and alloys thereof;

plating on said barrier layer a bondable layer, by electroless deposition, said bondable layer having a thickness of at least about 0.4 [1.5] μm , said bondable layer selected from a group consisting of gold, palladium, platinum, and silver; and

bonding one of said metal wires onto said bondable layer.

18. (amended) The method of Claim 16, wherein said step of plating on said seed metal a barrier layer comprises plating said [a] barrier layer having a thickness in the range of about 0.5 μm to about 1.5 μm .

19. (amended) The method of Claim 16, wherein said step of plating on said barrier layer a bondable layer comprises plating said [a] bondable layer having a thickness in the range of about 0.4 μm to about 1.5 μm .

22. (amended) A method for forming metallurgical connections between metal wires and bond pads positioned on integrated circuits having copper interconnecting metallization, comprising:

depositing palladium seed metal to activate the surface of said copper metallization of said bond pads;

plating on said seed metal a layer of nickel, by electroless deposition, said layer of nickel having a thickness of at least about 0.5 μm ;

plating on said layer of nickel a layer of gold, by electroless deposition, said layer of gold having a thickness of at least about 0.4 [1.5] μm ; and

bonding one of said metal wires onto said layer of gold.

23. (amended) The method of Claim 22, wherein said step of plating on said nickel [barrier] layer a [bondable] layer of gold comprises the steps of:

conducting a self-limiting surface metal replacement; and

conducting an autocatalytic deposition.

24. (amended) The method of Claim 22, wherein said step of plating on said seed metal a [barrier] layer of nickel comprises plating a nickel [barrier] layer having a thickness in the range of about 0.5 μm to about 1.5 μm .

25. (amended) The method of Claim 22, wherein said step of plating on said [barrier] layer of nickel a [bondable] layer of gold comprises plating a gold [bondable] layer having a thickness in the range of about 0.4 μm to about 1.5 μm .